REMARKS

Claims 1-7 are presently pending in the application.

In Tables 1 and 2, "mass ppm," referring to component (C), has been changed to "mass %", which is merely a correction of a typographical error. This amendment is supported in the specification at least at page 17, lines 3 to 16. Additionally, claim 1 has been amended to recite that the lubricating base oil has a kinematic viscosity of 1 to 10 mm^2/s at 100°C, which is supported in the specification at least at page 5, lines 5-9. No new matter has been added by these amendments, and entry is respectfully requested.

The Examiner has rejected claims 1-7 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 3,853,772 of Adams ("Adams") in combination with U.S. Patent No. 6,617,286 of Sato et al. ("Sato"). The Examiner argues that Adams discloses extreme pressure lubricants having improved wear tolerance which comprise a lubricating base oil and, as additives, (a) hydrated alkali metal borates in an amount of 1 to 25 weight %, (b) an alkaline earth metal sulfonate which may be overbased, and (c) succinimide compounds. Adams allegedly teaches that the compositions are effective under high load conditions, such as in the gear sets used in automotive transmission differentials. The hydrated alkali metal borates allegedly include hydrated potassium borates, and the sulfonate compounds allegedly include calcium sulfonates. The Examiner argues that Adams teaches that additional additives may also be included. The Examiner acknowledges that Adams does not teach including a borated succinimide as claimed. However, the Examiner argues that Sato teaches that such additives are well-known in lubricant compositions suitable for use in transmissions.

Specifically, the Examiner argues that Sato teaches a lubricating oil composition for continuously variable transmissions which comprises a base oil of lubricating viscosity, a phosphorus-containing wear additive, a metal detergent, such as a neutral or overbased alkaline earth metal sulfonate or salicylate, and an ashless dispersant, such as a boron-containing succinimide. Sato allegedly teaches that the content of boron in the boron-containing product usually ranges from 0.1 to 5 weight % based on the total weight of the boron-containing succinimide. The Examiner thus concludes that it would have been obvious to have added the borated succinimide component of Sato as an additional additive in the lubricant composition of

Adams if its known imparted properties were so desired. Applicant respectfully traverses this rejection as follows.

It is known in the art of lubricating oils that there is a trade-off between obtaining good anti-wear properties (preventing wear loss) and achieving long fatigue life, the ability to prevent defects in the lubricated surfaces resulting from pitching or flaking. As described at page 2, lines 8-16 of the application, the extreme pressure properties and anti-wear properties of lubricating composition oils can be greatly enhanced by adding sulfur- or phosphorus-based additives. While sulfur-based additives provide excellent extreme pressure properties, they do not avoid wear caused by corrosion and abrasion.

Conversely, phosphorus-based additives cause less wear from corrosion and abrasion, but often cause problems due to a lack of extreme pressure properties, and thus do not avoid pitching or flaking when they are used alone in automatic transmissions. Therefore, it has been conventionally difficult to improve both the anti-wear properties and fatigue life of a conventional lubricating oil composition, particularly one which comprises a low viscosity base oil, such as one having a kinematic viscosity of 1 to 10 mm^2/s at 100°C.

However, Applicant has determined that by combining such a low viscosity base oil and specific components, it is possible to optimize both anti-wear properties and fatigue life. Specifically, a composition containing specific amounts of: (A) a boron-containing ashless dispersant, (B) an alkaline earth metal-based detergent with a base number of 0 to 500 mg KOH/g, and (C) an alkali metal borate or a hydrate thereof, provides favorable results. The advantageous effects of the presently claimed composition are demonstrated in Table 1 of the present application. It can be seen that all of the samples in Inventive Examples 1 to 7, which contained a lubricating base oil having a low kinematic viscosity of 3.8 mm^2/s at 100°C and components (A) – (C) in the claimed amounts, exhibited excellent anti-wear properties and long fatigue life.

However, as shown in Table 2, compositions which lacked (A), (B), and/or (C), or compositions in which the amounts of these components did not fall within the claimed ranges, did not exhibit the desired effects. Specifically, the samples of Comparative Example 4, which contained no component (C), and Comparative Example 1, which contained less than 0.02 mass

% of component (A), exhibited poor anti-wear properties. Further, the samples of Comparative Examples 2 and 3, which both contained less than 0.01 mass% of component (B), exhibited poor fatigue life. Accordingly, the criticalities of the claimed components and amounts thereof have been demonstrated.

As acknowledged by the Examiner, Adams does not teach or suggest the use of a borated succinimide in an amount of 0.02 to 0.1 mass % in terms of boron. However, Adams also does not teach or suggest the use of a low kinematic viscosity oil as claimed, nor would excellent anti-wear properties and long fatigue life have resulted from the composition of Adams.

Adams teaches in col. 11, lines 1-19 that extreme pressure properties of a lubricating composition may be evaluated using the "Four-ball" test, and that a satisfactory lubricant has a four ball score of not greater than 0.5 mm. As shown in the Table of Adams, compositions which met this requirement contained a hydrated alkali metal borate in an amount of 1 to 25 weight %, an alkaline earth metal sulfonate, and succinimide compounds (boron free), all dispersed in a paraffinic SAE 90 hydrocarbon oil (col. 10, line 40). Such hydrocarbon oils are known to have kinematic viscosities of 13.5 to less than 24.0 mm^2/s at 100°C. The compositions of Adams which have favorable wear properties thus have relatively high kinematic viscosities, not the claimed low kinematic viscosities of 1 to 10 mm^2/s at 100° C. Further, Adams does not teach or suggest a low kinematic viscosity oil-containing composition which exhibits both good anti-wear performance and low fatigue life. Since the composition of Adams which exhibits good anti-wear performance contains a relatively high kinematic viscosity lubricating oil, such as SAE 90 oil, there would have been no motivation to utilize a low kinematic viscosity oil as claimed.

The Examiner acknowledges that Adams does not teach including a borated succinimide (component (A)), but takes the position that borated succinimides are well known in the field of lubricant compositions to be suitable for use in transmissions, as disclosed by Sato. Sato is directed to lubricating compositions for continuously variable transmissions which comprise: (a) a wear preventative, (b) a metal detergent, and (c) a specific boron-containing succinimide. Sato teaches that such compositions provide a high coefficient of friction between metals and oxidation stability. However, Sato does not describe a composition which exhibits favorable anti-wear properties and fatigue life, the desirably for optimizing such characteristics, or the

difficulty with achieving good anti-wear properties and fatigue life when utilizing a low viscosity lubricating oil. Accordingly, there would have been no motivating to replace the boron-free succinimide of Adams, used with a high viscosity lubricating oil, with a boron-containing succinimide of Sato, used with a low viscosity lubricating oil. There would also have been no reasonable expectation that such a replacement would provide the results observed by the presently claimed invention. Accordingly, reconsideration and withdrawal of the § 103(a) rejection are respectfully requested.

Claim 3 recites that the alkali metal borate or hydrate thereof (component (C)) is contained in the composition in an amount of 0.0002 to 0.1 mass % in terms of boron. Sato does not teach or suggest an alkali borate, and such a concentration is not taught or suggested by Adams. Rather, the hydrated alkali metal borate of Adams, $NaBO_2$-H_2O, has a boron content of 11 g B/84 g total x 100 = 13 wt %. Adams teaches that the hydrated alkali metal borate is contained in an amount of 1 to 25 wt% in the composition. Accordingly, the boron content ranges from 13 x 1/100 to 13 x 25/100 = 0.13 to 3.25 wt% in terms of boron, and Adams does not teach or suggest the claimed range. Therefore, even the proposed combination of Adams and Sato does not teach or suggest all of the elements of claim 3.

Based on the preceding Amendments and Remarks, it is respectfully submitted that the pending claims are patentably distinct from the prior art of record and in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,
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